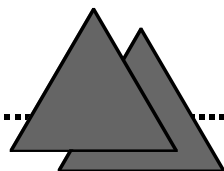


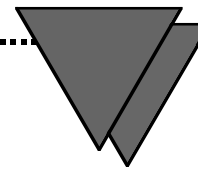
Siting Committee Workshop Evaluating CEQA and Permit Streamlining for Distributed Generation

April 20, 2000

California Energy Commission

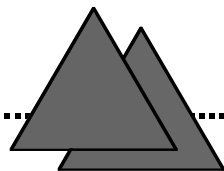
Judy Grau, Distributed Energy Resources
Program Manager



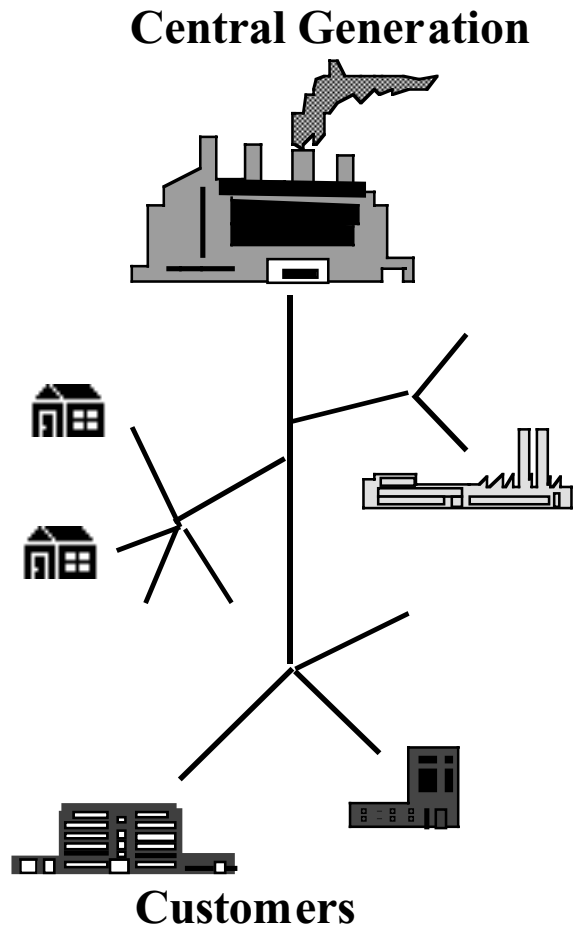


CPUC OIR Definition of DG

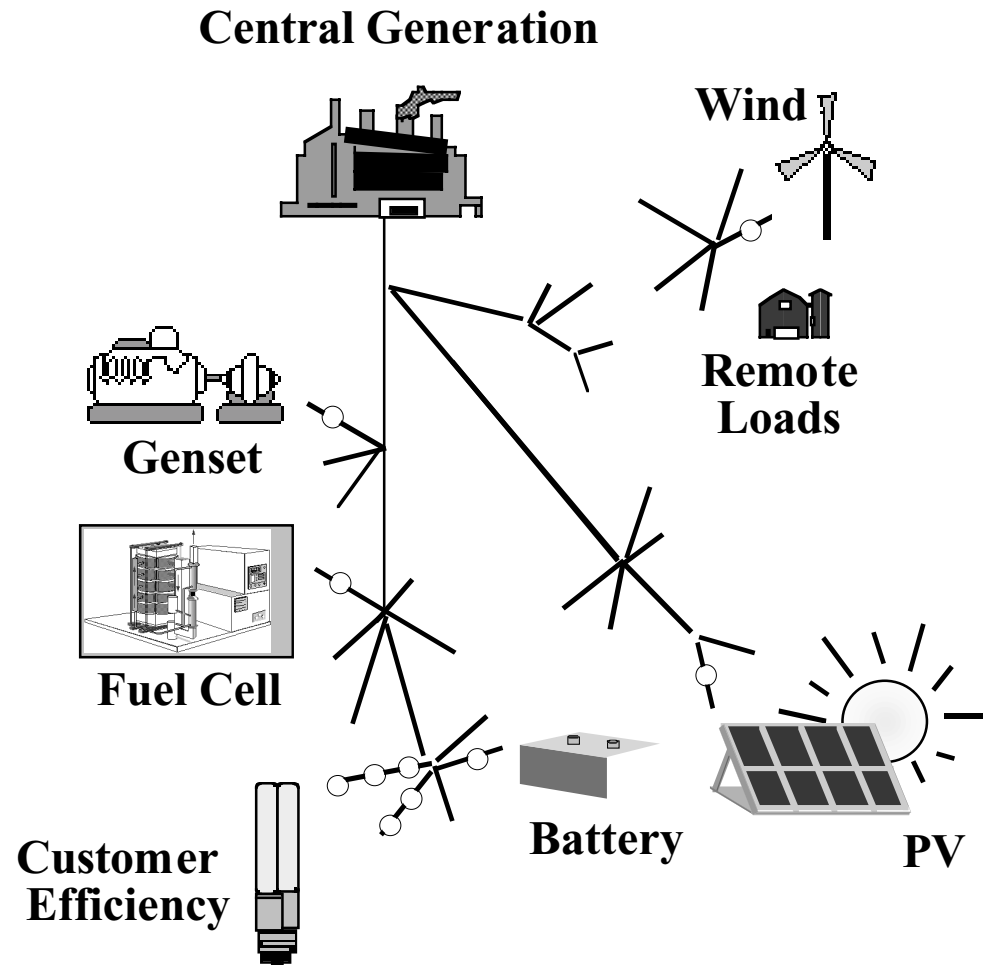
- u Generation, storage, or DSM devices, measures and/or technologies that are connected to or injected into the distribution level of the T&D grid.
- u Located at customer s premises on either side of meter
- u Located at other points in distribution system, such as utility substation



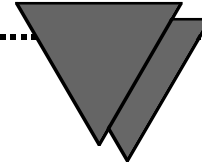
Today's Central Utility



Tomorrow's Distributed Utility?

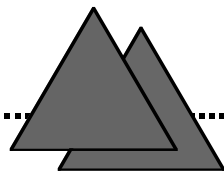


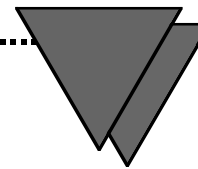
' Distributed Utility Associates, Used with Permission



Technologies

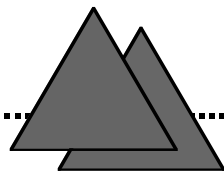
- u Fossil-fuel based distributed generation
- u Non-fossil fuel based generation
- u Storage technologies

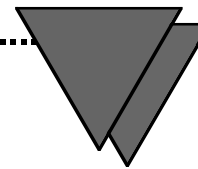




Common Traits in DG/DER Technologies

- u Mass produced
- u Modular
- u Small (<20 MW)
- u Support system reliability
- u Provide economic advantage to end-user, ESP, and/or UDC
- u Provide customer and UDCs an alternative to standard generation options





Economic Advantage From DG/DER Systems

- u Economic advantages included one or more of the following:

Load management

Reliability

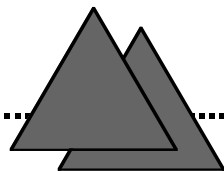
Power quality

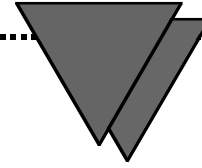
Fuel flexibility

Cogeneration

Deferred or reduced T&D investment or charge

Increased distribution grid reliability/stability





Fossil Fuel Technologies

- u Internal-combustion engines
 - Diesel engines
 - Natural gas engines
- u Micro-turbines
- u Fuel cells
- u Stirling engines

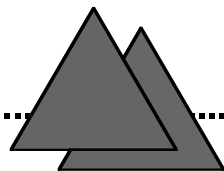




Photo courtesy of Caterpillar

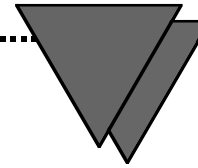


Photo courtesy of Caterpillar



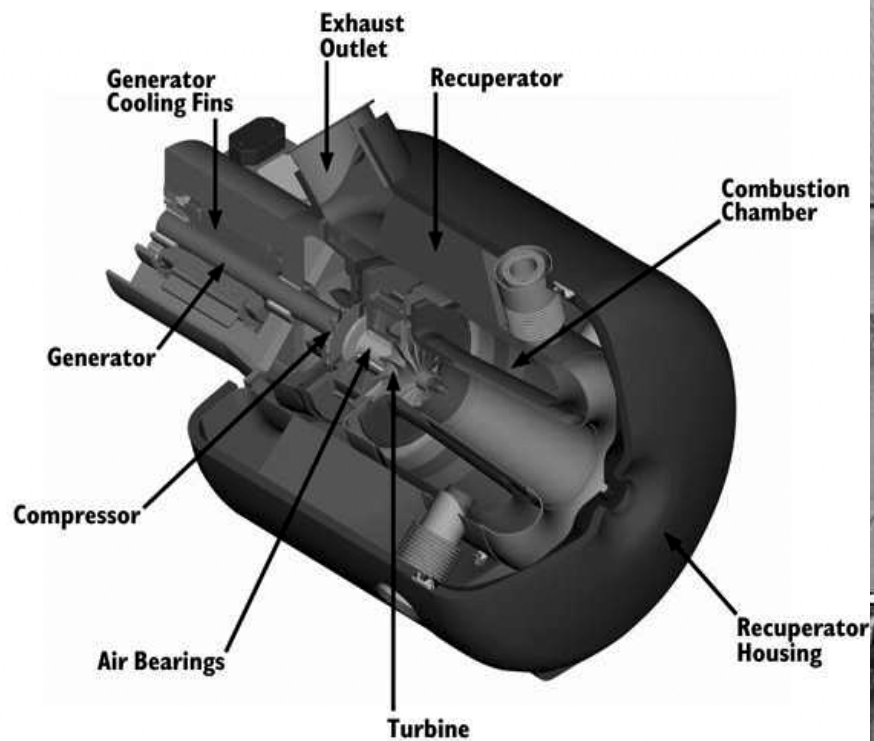
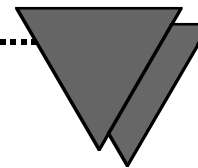


Diagram above courtesy of Capstone.

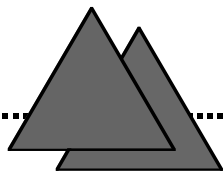
Photo on right courtesy of Bowman.





Commercial Status of DG/DER

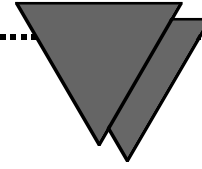
	IC Engines	Small Turbines	Micro-turbines	Fuel Cell
Commercial Availability	Well established	Well established	New industry	Well established
Size	50 kW-5 MW	1 MW — 50 MW	25 kW — 75 kW	1 kW — 200 kW
Installed Cost (\$/kW)	\$800 — \$1500	\$700 — \$900	\$500 — \$1300	\$3000
O&M Costs (cents/kWh)	0.7 — 1.5	0.2 — 0.8	0.2 — 1.0	0.3 — 1.5
Fuel Type	Diesel, propane, NG, oil & biogas	Propane, NG, distillate oil & biogas	Propane, NG, distillate & biogas	Hydrogen, biogas & propane
Typical Duty Cycles	Baseload	Baseload, intermed. peaking	Peaking Intermed. Baseload	Baseload





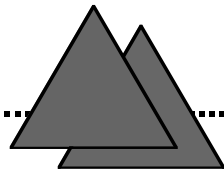
Environmental and Operational Attributes of Fossil Fuel Based Distributed Generation

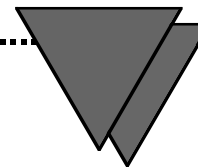
Technology	IC Engines	Small Turbines	Microturbine	Fuel Cell
Electric Efficiency (LHV)	30-50%	25-40% (simple cycle)	20-30%	40-70%
Fuel	Diesel, Propane, Nat'l Gas, Oil, Biogas	Propane, Nat'l gas, Distillate oil, Biogas	Propane, Nat'l gas, Distillate oil, Biogas	Hydrogen, Biogas, Propane
Usable Temperature for CHP (F)	Ft Diesel 1180-190 Other 300 to 500	500-1100	400-650	140-700
Nox Emissions (lbs/MWh)	Ft Diesel 3-33 Others 2.2-28	0.3 to 4.0	0.4 to 2.2	<0.02
Availability	90-97%	90-98%	90-98%	>95%
Noise	Moderate to high (requires building enclosure)	Moderate (enclosure supplied with unit)	Moderate (enclosure supplied with unit)	Low No enclosure required



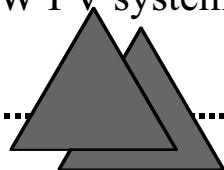
Renewable Energy Technologies

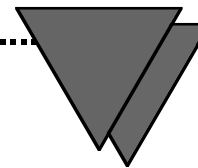
- u Photovoltaics
- u Solar-dish Stirling
- u Small wind systems (<40 kW)
- u Large wind systems
- u Stirling engines (biomass, landfill gas)



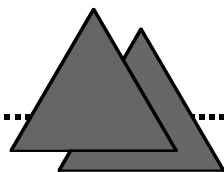


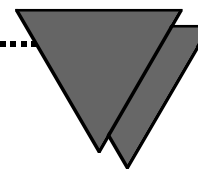
13 kW PV system. Photo courtesy of Edison Technology Solutions





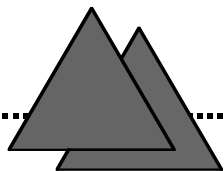
2 kW PV & Wind hybrid system. Photo courtesy of Edison Technology Solutions

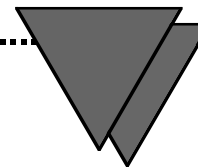




Commercial Status of DG/DER

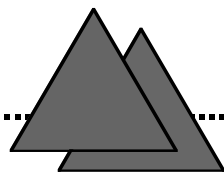
	Photovoltaic	Dish-Stirling	Small Wind	Large Wind
Commercial Availability	Well established	Year 2000?	Well established	Well established
Size	0.30 kW — 2 MW	30 kW and larger	600 watts — 40 kW	40 kW — 1.5 MW
Installed Cost (\$/kW)	\$6,000 — \$10,000	\$10,000/kW (now) \$400/kW (later)		\$900 — \$1,100
O&M Costs (cents/kWh)	Minimal		Varies	1.0
Fuel Type	Solar	Solar and NG (hybrid mode)	Wind	Wind
Typical Duty Cycles	Peaking	Peaking or Interm. Hybrid mode	Varies	Varies

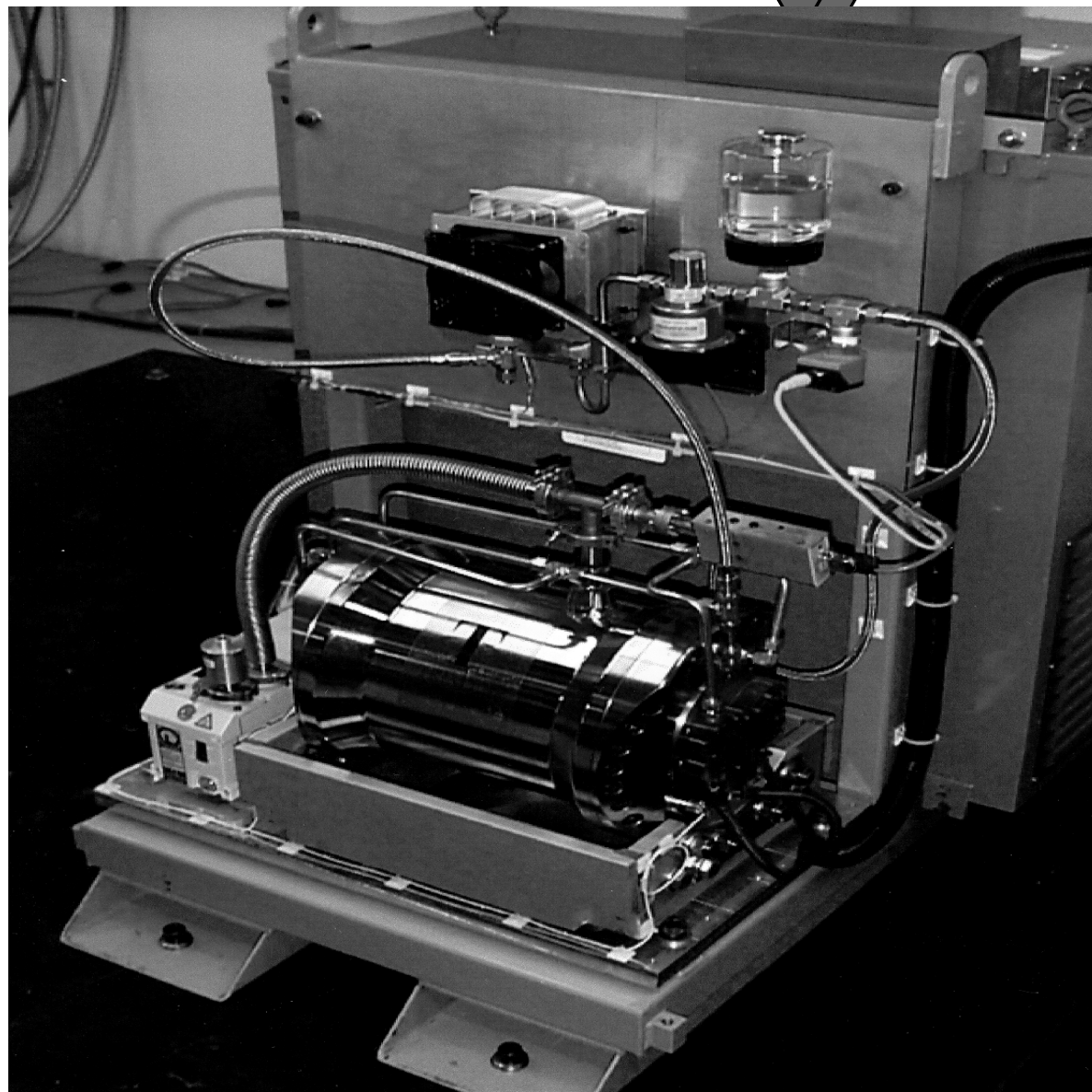




Storage Technologies

- u Batteries
- u Modular pumped hydro
- u Superconducting magnetic energy storage (SMES)
- u Flywheels
- u Ultracapacitors



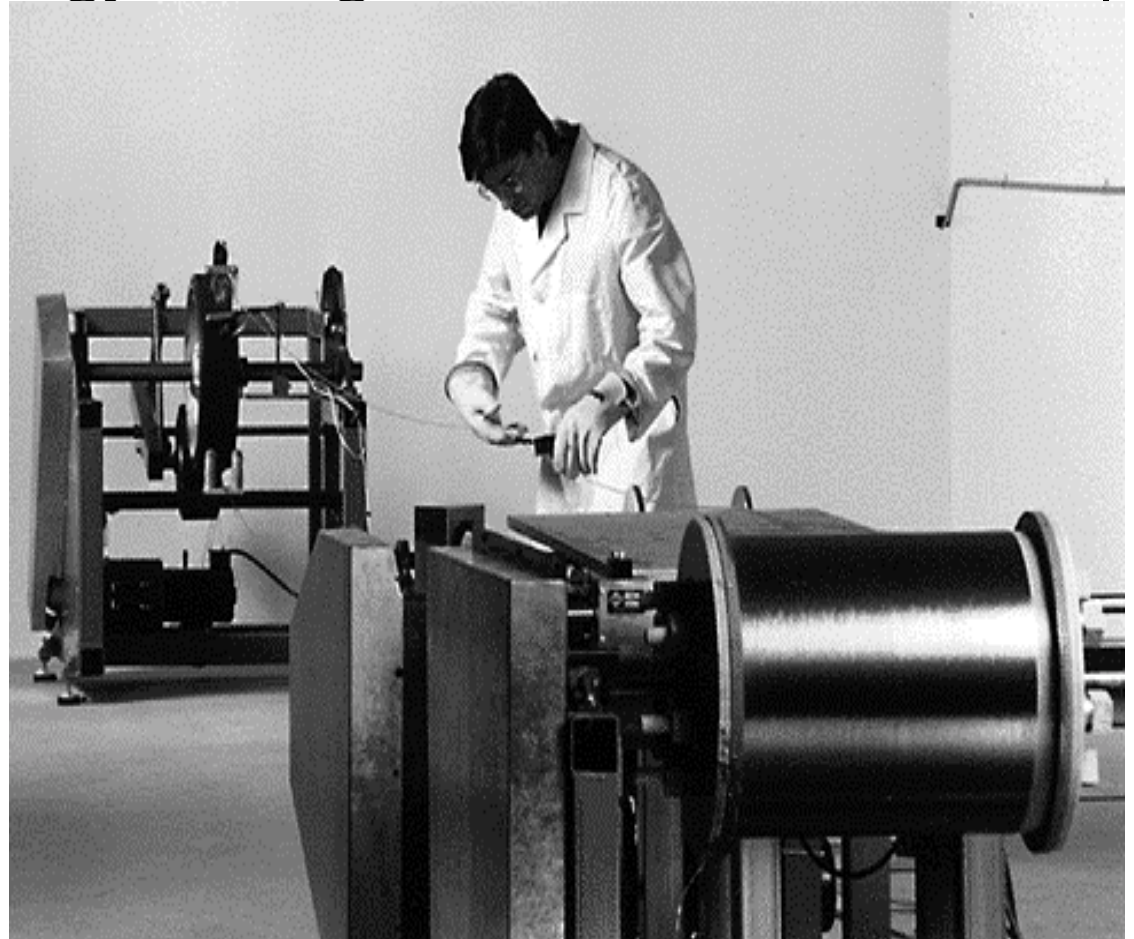


2kWh Flywheel.

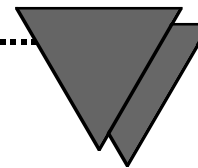
Photo courtesy of
Trinity Flywheel, Inc.



Superconducting Magnet Provides Compact Energy Storage



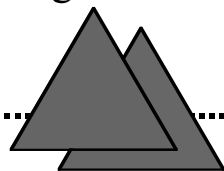
Super Conducting Magnet Assembly. Photos courtesy of American Superconductor

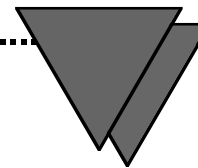


PQ AC Installed at Fairbluff, NC



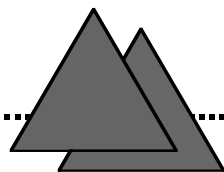
Mobile super magnetic energy storage (SMES) unit. Photo courtesy of American Superconductor

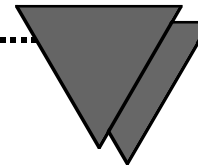




Most Likely Users of DG in Next Five Years

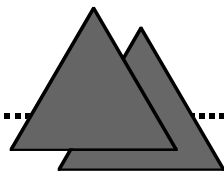
	IC Engines	Small and micro turbines	Storage	Fuel Cell	PV	Small Wind	Large wind
Indust.	X	X	X	X			
Comm.	X	X	X	X	X	X	
Resi- dential	X			X	X	X	
UDC	X	X	X	X	X		X

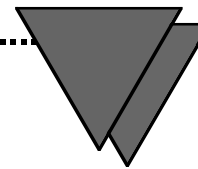




Permitting Issues

- u Slow review, or denial, of distributed energy projects due to a lack of:
 - consolidated, clear information on siting requirements
 - universally accepted standards
 - clearly defined impacts and benefits
- u Permit overload? Maybe someday...





Air Quality Issues

- u Some technologies do not trigger permit thresholds or are otherwise exempt (e.g., emergency use only)
- u Amount and types of DER penetration not known
- u Cumulative impacts could be significant

